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NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

A68-34

DEC 19 1968

Mr. David D. Thomas
Acting Administrator
Federal Aviation Administration
Department of Transportation
Washington, D. C. 20590

Dear Mr. Thomas:

As a result of the investigation of a Beech Baron Model 95-B55 fatal accident, our letter of January 12, 1967, to the Administrator recommended reevaluation of the aircraft fuel system. The evidence in this accident indicated the likelihood of its having been precipitated by fuel starvation while the aircraft was in a right slip attitude. Subsequent flight testing confirmed that loss of an engine by fuel starvation would result after a few seconds in a sideslip with as much as a third of a tank fuel level.

By FAA letter of February 20, 1968, we were advised that the reevaluation had revealed no area of noncompliance with the FAR's; that the cited accident was apparently an isolated case of suspected fuel interruption in this manner; and that the cited flight testing was apparently more severe than required by regulations. For these reasons it had been decided no corrective measures to the Beech 95-B55 airplane were warranted at that time.

Subsequent experience has now caused us to conclude that there is indeed a basic fuel system deficiency which, irrespective of general compliance with the relevant FAR provisions, does constitute an undue hazard to flight in general aviation operations. This experience is outlined in the following.

A Beech Debonair 33, N-8966M, became a total loss upon approach to the Fullerton, California, Airport on March 3, 1968. The approach was being conducted with an estimated 19 to 25 gallons of fuel in each 40-gallon tank. The airport controller suggested a 360 degree turn because of proximity to other approaching aircraft, but the pilot elected instead to conduct S-turns for the purpose of additional separation. Shortly after the pilot's announcement to this effect, the aircraft was observed diving to the ground. The pilot and his two sons were killed. Although examination of the engine revealed no indication of a pre-impact engine failure condition, there had been no sign of power development at impact. Accordingly, fuel starvation, as a result of fuel tank outlet uncovering during the final approach maneuvering, is suspected as contributory in this accident.

During takeoff from the Fullerton Airport on June 25, 1968, a Beech Baron BE-55, N8442N, experienced a right engine power interruption, dropped off on its right wing and plunged to the ground in Buena Park, California. All four occupants of the aircraft were fatalities. The left fuel selector was found set for the left main tank, but the right selection was set for the right auxiliary tank. Since this is an abnormal and illogical fuel tank setting combination, it is considered likely that the right selector was moved from the normal main tank setting during the takeoff in an attempt to recover right engine power. Fuel quantity was believed to have been below one-half. Again, with no indication of mechanical powerplant failure in evidence, fuel feed interruption to the right engine is suspected.

The Beech Baron 95-D55, N-304HA, air taxi accident of October 29, 1968, at Waterville, Maine, was quite definitive for causal area. Left engine power failure was experienced during rotation after a running, turning takeoff initiation. Shortly thereafter directional control was lost and the aircraft struck several large trees to the left of the runway heading. The aircraft burned in its final inverted position. Although the fuel selectors were found in the auxiliary tank position instead of the prescribed main position for takeoffs, the fact remains that the left engine quit "when it was supposed to" after a right-hand running and turning takeoff with a low fuel supply in this system. The fuel tankage was estimated at eight gallons in each 31-gallon auxiliary tank. A November 10, 1967, "Caution" note in the FAA-approved Airplane Flight Manual (AFM) states: "When taking off with minimum fuel do not make a tight turning type takeoff. The fuel may be conveyed away from the outlet during the turn causing an interruption in engine operation."

Beechcraft Service Letter No. 65-9, issued in April, 1965, for Model 35 Bonanzas and Model 33 Debonairs, also deals with "tight turning type" takeoffs. The Letter states "it is possible" that air will be allowed into the fuel system as a result of initiating a takeoff in this manner, and that in such a case "the air will reach the engine at about the time the airplane becomes airborne and could cause momentary power interruption." It goes on to say that "this does not create a hazard but can be disconcerting." We maintain that assessing such a power interruption as "momentary" in duration, and declaring no hazard from a power loss of this nature at such a flight stage, can constitute undue optimism. The service letter further states that if such a takeoff is executed it would be advisable to select the tank on the inside of the turn. It should be noted that this option, suggested for these single-engine aircraft, is not practically available with the twin-engine Beechcraft models, since use of main tank to engine on each side is recommended for takeoff.

A Beechcraft AFM Supplement sheet, Part No. 130776, dated June 10, 1968, also provides caution notes in this area for Baron and Model 95 Travel Air aircraft. This supplement cautions against making a turning type takeoff "If either 40 gallon main tank contains less than 25 gallons of fuel." For flight operation it states, "To prevent fuel flow interruption, avoid prolonged operation in a slip or skid attitude under low fuel condition." Our contention is that a fuel system so sensitive to as relatively routine a takeoff practice as this, as to result in fuel starvation even though the tank fuel level might be well over half full, should at the least not be continued in production. As far as slips and skids in flight are concerned, there is flight test experience that only a very few seconds in a slip attitude with a low fuel level will cause fuel flow interruption. This appears to be a treacherous fuel system characteristic when it is considered that uncoordinated maneuvers are so likely to occasionally occur in general aviation operations. Further, one of the most probable occasions for such mansuvers is during landing approach, which would also be one of the likeliest times for a low fuel state.

An aborted takeoff incident at Burbank, California, on September 2, 1968, involving Beech B-55 Baron N-9671Y, also bore out the fuel system sensitivity to a running takeoff. In this case an FAA flight test pilot reported that, when cleared for immediate takeoff, he made a "normally fast 90° left turn" onto the runway and the right engine failed at about 50 knots. Fuel quantity in each main tank at the time was stated to have been at least 17.3 gallons.

The flight testing conducted with a Beech Baron 95-B55, N-8313N, on July 3, 1968, out of Beech Field by an FAA Central Region pilot and a Beech test pilot also confirmed that fuel flow interruption would result from sustained sideslips with a fuel level only slightly less than one-half full. It was also demonstrated that, if a large yaw angle were allowed to develop after an engine failure, fuel interruption to the remaining engine could occur if its tank was less than one-quarter full.

There have been other cases noted which have further indicated this problem area, but for which there is insufficient documentation available to cite them here as cases in point.

It has also been noted that the various other Beechcraft models have fuel tank installations with characteristics similar to those that have created the troubles demonstrated in the Baron, and therefore are subject to the same problem area.

In consequence of the foregoing, it is recommended that a suitable production change be incorporated in all affected Beech aircraft. The goal of this design change, such as tank baffling,

tank surge chamber, and/or fuel outlet plumbing reconfiguration, should be the provision of a dependable fuel supply from each tank in use, throughout the declared usable fuel range, and irrespective of such as turning takeoffs and uncoordinated flight maneuvers.

It is further recommended that all affected Beech aircraft currently in service, as well as all those which will go into service before the above-recommended production change becomes effective, be provided with cockpit placards by means of an Airworthiness Directive. The placard should provide information similar to that of the Beechcraft AFM Supplement of Part No. 130776. Placarding is considered necessary because of the fact that, for one reason or another under the current system, important cautionary advisories such as this do not get through to all affected general aviation pilots.

One final recommendation of a general nature has been emphatically brought to mind from consideration of this case. This is that general aviation certification criteria be made more stringent, by regulations and/or implementing interpretation thereof, so that basic design deficiencies, such as exemplified in this letter, are not allowed to be perpetuated over many years of otherwise tremendous technical advance in state of the art. The case in point here is a fine example where a design fix, making the difference between the fuel system's being marginally or interpretatively airworthy and completely airworthy, is obvious and comparatively inexpensive. The economic argument competitively from one manufacturer to another becomes invalid if appropriate safety design requirements are enforced across the board.

We now have another accident that has the earmarks of yet another case in point. A Piedmont Aviation Beech Baron D55, N-7701R crashed on takeoff on December 17 at Raleigh-Durham, N. C. after a left engine power failure. Although not confirmed, a running and turning takeoff is believed to have preceded the accident. The left fuel tanks were impact-ruptured, but the right tanks were found about one-half full. The pilot and one passenger are in critical condition while the other passenger was killed.

A Board representative has discussed the foregoing situation with personnel of your Flight Standards Service here in Washington as well as in Kansas City. Our technical staff is available to provide you with further information or assistance as required.

Sincerely yours,

Original signed by

Joseph J. O'Connell, Jr.

Joseph J. O'Connell, Jr.
Chairman